

## Forces and Motion

### 5-5 The student will demonstrate an understanding of the nature of force and motion. (Physical Science)

#### 5-5.3 Explain how unbalanced forces affect the rate and direction of motion in objects.

**Taxonomy level:** 2.7-B Understand Conceptual Knowledge

**Previous/Future knowledge:** In 1<sup>st</sup> grade (1-5.1), students explained the importance of pushing and pulling to the motion of an object. In 3<sup>rd</sup> grade, students compared the motion of common objects in terms of speed and direction (3-5.2) and explained how the motion of an object is affected by the strength of a push or pull and the mass of the object (3-5.3). Students have not been introduced to the concept of unbalanced forces or rate of motion of objects in previous grade levels. Students will further develop the concepts of the effect of balanced and unbalanced forces on an object's motion in terms of magnitude and direction in 8<sup>th</sup> grade (8-5.6).

**It is essential for students to** know that unbalanced forces change the rate and direction of the motion of objects.

- Several forces can act on an object at the same time.
- Sometimes forces are balanced which means that they are equal in strength but opposite in direction.
- Balanced forces do not change the motion of objects only unbalanced forces cause changes in motion.
- An unbalanced force is one that does not have another force of equal magnitude and opposite direction off-setting it.
- *Rate of motion* is the speed of the object or how fast or slow the object is moving.
- Unbalanced forces can change the rate or direction of motion of an object in different ways:

#### *Object at rest*

- If an unbalanced force acts on an object at rest the object will move in the direction of the force.
- A stronger force (push or pull) will make it move faster.

#### *Object in motion*

- If an object is moving, an unbalanced force will change the motion of the object in different ways depending on how the force is applied. The unbalanced force may speed the object up, slow it down, or make it change directions.
  - If the force is applied in the same direction as the object is moving, the object will speed it up.
  - If the force is applied in the opposite direction as the object is moving, the object will slow it down or stop it.
  - If the force is applied to the side of the moving object, the object will turn.

**It is not essential for students to** know the difference between speed and velocity, or the concept of acceleration.

## Forces and Motion

### 5-5 The student will demonstrate an understanding of the nature of force and motion. (Physical Science)

#### Assessment Guidelines:

The objective of this indicator is to *explain* how unbalanced forces affect the rate and direction of motion in objects; therefore, the primary focus of assessment should be to construct a cause-and-effect model of how the rate and direction of motion is affected by unbalanced forces. However, appropriate assessments should also require students to *identify* the meaning of unbalanced forces, rate, and direction of motion; *summarize* information about unbalanced forces and how they affect rate and direction of motion; or *illustrate* with drawings, diagrams, or word descriptions the effects of unbalanced force on an object.